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ABSTRACT

This thumbnail review of the symbiosis between psychology and education is intended to suggest that perhaps those concerned with education have borrowed too uncritically the fashionable topics in psychology. What is of particular concern is the usefulness of the anxiety construct for research and theory dealing with individualized instruction (II), and attribute treatment interactions. Individualized instruction today implies individualization in only one respect: pupils proceed through the same materials, in pretty much the same way, but they do so at their own rate. Individualization of the method of instruction hinges upon the establishment of attribute treatment interactions (ATIs). The major purpose of this paper is to critically evaluate ATI studies in which anxiety has been used as the attribute variable. A comparison of the distinguishing characteristics of individualized and conventional instructional practices suggests a compelling rationale for expecting an interaction between anxiety and these two instructional strategies: In II, students are required to master a clearcut instructional objective; in conventional instruction, objectives are frequently non-existent and/or vague. Two other studies of this nature were reviewed. All of the studies reviewed are inconclusive regarding ATIs between anxiety and classroom instruction or II. However, the present rationale suggests that such interactions are possible. (CK)

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Anxiety, Attribute Treatment Interactions,
and Individualized Instruction¹

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It is not original to observe that educational psychology borrows extensively, and perhaps indiscriminately from psychology in general. When a topic is fashionable in psychology its echo can be perceived quite rapidly in educational psychology. Thorndike's research on the law of effect found quick application in the provision of rewards for achievement in the form of gold stars, silver stars and such. At the time in psychology when the preeminence of the S-R point of view was being questioned by Gestalt psychologists these movements quickly found sympathetic vibrations in education - what with the core curriculum, teaching reading by beginning with the whole word rather than the letters, and similar movements. In the post-war period the psychoanalytic influence in psychology was rapidly mirrored in education with concern for teaching mental health, teaching the whole child, and with the topic of our symposium: anxiety. This thumbnail review of the symbiosis between psychology and education is intended to suggest that perhaps those of us concerned with education have borrowed too uncritically the fashionable topics in psychology, or at least the topics guaranteed to prevent us from perishing - in the world of publish or you know what. Lest I be accused at throwing stones at glass houses, a look at the table of references to this paper will reveal that I, too, have enthusiastically participated in this pasttime for 10 these many years.

Since it is probably as damaging to discard a topic uncritically as it is to accent it, let me specify the areas to which this paper will refer. What is of particular concern from the present point of view is the usefulness of the anxiety construct for research and theory dealing with individualized instruction (II), and attribute treatment interactions. Individualized instruction is meant to refer to instructional processes in which pupils proceed through the curriculum at their own rate, working predominately independently both of the teacher and of their classmates in order to master specified objectives. Such II can be accomplished via programmed, computer-assisted, or computer-managed instruction, and by prepackaged instructional programs.

Individualized instruction as it exists today typically implies individualization in only one respect: pupils proceed through the same materials, in pretty much the same way, but they do so at their own rate. Ideally, of course, the instructional method by which students master the objectives would also be individualized. Such individualization implies that the instructional method would be suited to the cognitive and emotional characteristics of the student in order to achieve an optimal match between student attributes and instructional strategy. Adaptation of instructional methods to students, of course, requires the presence of well established interactions between student characteristics and instructional methods. The area of research dealing with this problem has variously come to be known as aptitude treatment interaction (Cronbach & Snow, 1969), attribute treatment interaction (Tobias, 1970), or trait-treatment-interactions (Berliner & Cahen, in press). Since two of these three labels permit use of the abbreviation ATI, and for obvious other

reasons, this body of research will be referred to as attribute treatment interaction, or ATI for short, in this paper.

Individualization of the method of instruction hinges upon the establishment of ATIs. It will, therefore, be the major purpose of this paper to critically evaluate ATI studies in which anxiety has been used as the attribute variable. In turn, evaluation of the success and outcome of these investigations, should permit some judgements to be made regarding the place of anxiety in individualized instructional contexts.

Rationale

A comparison of the distinguishing characteristics of individualized and conventional instructional practices suggests a compelling rationale for expecting an interaction between anxiety and these two instructional strategies. Typically in II, students are required to master a clearcut instructional objective. In conventional instruction, such as classroom lectures, textbook readings, film presentations, etc., objectives are frequently non-existent, and when present are stated in vague and ambiguous terms. In II, the student may take as much or as little time as is felt necessary for the mastery of a particular set of objectives. In conventional instruction, on the other hand, students often have only one opportunity to listen to a lecture and have to do so at a group rate which may be unrelated to their needs. If a criterion test indicates that mastery has not been attained in II, the student is looped back through the materials and then retested. In conventional instruction of course, the student does not have these opportunities for repeated study, and the anxious student should, therefore, get lower grades on a group-referenced examination, than in the criterion-referenced situation typically encountered in II.

Finally, another major difference between individual and classroom instructional practices is the presence of evaluative stress relating to competition with other students which is present in the conventional classroom. Conventional practices typically allow the student to compare himself to the imagined mastery of the content by fellow students, and the opportunities for negative self evaluation in such comparisons are, much greater than in II. These comparisons suggest that students prone to respond with anxiety have more occasions for anxiety to be aroused, maintained, and increased in the conventional instructional procedure.

Studies of the interaction between anxiety and conventional or II practices are conspicuous because of their rarity. The reasons for this are obvious. It is difficult to ascertain whether students who are exposed to one or the other of these practices are in fact learning the same content. Whenever a lecture, or general textbook is compared to II, it is not at all certain that students have in fact been exposed to the same subject matter. Conventional instruction is typically not as tightly organized and well controlled as is II, hence a comparison of these methods leaves questions whether similar content was covered by these two strategies.

For these reasons, comparisons of individualized and conventional instructional strategies typically begin with an individualized course, such as an available CAI, CMI or programmed instruction course. This course is then altered in one of a number of ways which are presumed to

be similar to conventional instructional practices. In programmed instruction, for example, a program requiring overt responses for which feedback is provided, is altered by filling in the response blanks into a "reading" format. In turn, the reading format is assumed to be similar to a textbook presentation. This is clearly fallacious reasoning since it is a rare textbook which has the tightness of organization and the amount of repetition of most instructional programs. The altered program is, thus, not representative of conventional instruction, but representative of an altered and degraded program. Therefore, much of the literature to be reviewed below tells us little about ATIs between anxiety and individual or conventional instructional strategies. It tells us more about ATIs between anxiety and an instructional strategy presumed to be optimal, as opposed to an individualized strategy which has been altered in ways the researchers expected would reduce their effectiveness substantially.

Speilberger, O'Neil and Hansen (1972) compared the proportion of errors, number of avoidance responses, and state anxiety scores for 16 seventh grade students working on a science curriculum in both a laboratory setting, and on CAI. The results indicated that the lab setting evoked more avoidance responses, higher state anxiety, and a greater proportion of errors. Of further interest was the finding that high and low state anxiety groups differed on the mean number of avoidance responses in the laboratory setting, but not in CAI. Finally, while HA students made more errors than LA students in both CAI ($t=2.68$) and lab settings ($t=3.17$) the effect was larger in the latter group. Even though these results can only be viewed as suggestive, due to the small sample, they confirm the rationale that ATIs with anxiety may be expected in comparisons of classroom based and II procedures.

There are only two other ATI studies between anxiety and individualized and conventional instructional practices which were found for this review. Flynn and Morgan (1966) investigated the effects of anxiety on achievement in an introductory unit on vector geometry. Elementary school students were separated into low, medium, and high anxiety groups on the basis of a test anxiety questionnaire. One set of students learned the material from an instructional program, while another was instructed by teachers. "Provisions were made to insure uniformity of subject matter content for all six classes" (p. 260). A 2 x 3 analysis of variance revealed no significant main effects or interactions. Another ATI study was reported by Ripple, Millman, & Glock (1969). These investigators looked specifically for disordinal ATIs between a number of attributes and programmed or conventional instruction in 22 schools. No interactions between instructional strategy and anxiety, or any of the other personological variables investigated were found.

These studies, while not encouraging, are certainly not conclusive regarding ATIs between anxiety and classroom instruction or II. One purpose of this paper is to encourage investigators to take the risk of imperfect control regarding similarity of coverage in such studies in order to meaningfully examine this ATI question.

A convenient organization for purposes of this discussion is to divide the studies dealing with anxiety and variations of II courses into two components: Studies using trait anxiety measures, such as the Taylor Manifest Anxiety Scale (1953), Test Anxiety Scales (Mandler & Sarason, 1952), or other comparable measures. A second section will deal with papers in which State anxiety has been investigated.

Trait Anxiety Studies

Lache (1967) studied the effects of three levels of anxiety, two levels of ability, and four modes of responding to a linear program dealing with vocabulary. A $4 \times 3 \times 2$ analysis of variance revealed no significant main effects or interactions. Tobias & Williamson (1968) studied two levels of manifest anxiety, and three response modes to a linear program dealing with binary numbers. An analysis of covariance of this 2×3 design, with pretest scores used as a covariate, revealed no significant main effects or interaction for achievement or attitude data.

Campeau (1968) reported a significant interaction between anxiety and feedback in programmed instruction. High anxiety (HA) girls achieved more than the low anxiety (LA) group in the standard constructed response with the reinforcement condition. When the reinforcement was removed, however, the achievement of the LA students exceeded that of the HA group. There were no significant effects for two similar groups of boys. While it is encouraging to find a significant result, Campeau's data are difficult to interpret, since her dependent measure consisted of gain scores from pre- to posttest. Difficulties with such data are well known (Cronbach and Furby, 1969) and therefore raise question about the meaning of these findings.

Tobias and Abramson (1971) studied the effects of three response mode, two stress conditions, and two types of anxiety on achievement on a linear program containing both familiar and technical material. A modest but significant interaction between debilitating anxiety and stress was obtained on easy, familiar content, however, none of the predicted interactions on the more difficult technical subject matter emerged. Hall (1970) also studied

the interaction among test anxiety, stress, and subject matter difficulty in a linear program. Even though state anxiety measures were employed in this investigation as well, it is convenient to indicate here only that no interactions between anxiety and posttest performance were observed. In a number of other studies, performance on program or posttest was related anxiety scores. Since instructional treatments were not varied these will not be reported here.

In most of the studies cited above the question of the degree to which anxiety was actually aroused while students were working on the experimental materials was aroused. A general anxiety measure, pre-supposes that the student reacts to the experimental situation with the same kinds of stress that he manifests in his day-to-day activities. Anyone who has ever actually conducted such an experiment with volunteer subjects required to participate in research for credit in a psychology course will certainly question this assumption. One way out of this bind of assuming that anxiety was actually engaged during the research is to implement stress conditions. The two studies utilizing such a condition (Hall, 1970; Tobias & Abramson, 1971) both report that there was still some question as to whether anxiety was actually aroused in the research situation.

Another way out of the bind of the presence of anxiety in the research situation is to actually measure anxiety while students are working on the instructional, and test materials. Spielberger's (1966) distinction between Trait and State anxiety theory offered a useful response to these problems. Trait anxiety is conceptualized as similar to the construct measured by general anxiety scales discussed so far and constituted

a relatively stable personal predisposition to respond to evaluative situations with stress and feelings of negative self-regard. State anxiety, on the other hand, refers to the degree to which anxiety is engaged in specific situations; it is expected to fluctuate over time and be highly responsive to situational stress. The operational measure of these constructs is the State and Trait Anxiety Inventory, STAI, (Spielberger, Gorsuch, and Lushene, 1970). O'Neill, Spielberger, and Hansen (1969) interspersed a brief five-item version of the A-State scale during a learning task administered via CAI. Their results indicated that A-State measures had a high relationship with learning scores, whereas A-Trait measures did not. These studies, thus, suggested that the failures to establish meaningful ATIs between learning from II and anxiety might be due to the fact that most studies utilized trait measures rather than the situationally sensitive state measures. The next section of this paper will thus review the studies dealing with state anxiety.

State Anxiety

Hansen (1972) studied the interaction between state anxiety and presence or absence of feedback in a CAI course dealing with the imaginary science of Xenograde systems. The interaction between feedback and state anxiety failed of significance, and, in any event, appeared to be partially opposite to the predicted relationship.

Merrill and Towle (1971) investigated the effects of providing behavioral objectives and/or criterion test items on the acquisition of the same imaginary science. There were no significant A-State by treatment interactions on achievement though one interaction on display latency was marginally significant ($p < .10$). On another study, Merrill and Towle (1972) reported that providing students with course objectives

in a graduate level educational research CMI course tended to reduce state anxiety. Tobias and Duchastel (1972) were unable to replicate this finding in a CAI research setting.

Finally there are a series of related studies utilizing a program dealing both with familiar facts concerning heart disease, and technical content concerning the diagnosis of myocardial infarction from the fifth precordial lead of electrocardiogram. In the first of these, Leherissey, O'Neil, and Hansen (1971a) found an interaction between A-Trait anxiety and response modes on achievement from the familiar program. The second investigation, Leherissey, O'Neil, Heinrich, and Hansen (1971b) replicated the procedures of the prior study quite closely and, in addition, included both a long and a short form of the program. Again, A-Trait by response mode by program length interaction was found, but this interaction tended to be in the opposite direction of that reported in the previous investigation. That is, in the prior study high A-Trait students in the constructed response group performed better than low A-Trait students, and low A-Trait students in the reading group performed better than high A-Trait students on the familiar portion of the posttest; the reverse was true in the second study. In addition, a main effect for A-State was found on the familiar posttest, but there was no such effect in the prior study. The second study also yielded an A-State by response mode interaction on the familiar posttest. The final study in this set was conducted by Leherissey (1971) involving state curiosity, induced curiosity, as well as response mode and trait and state anxiety. In this study a response mode by A-State interaction was found on the technical posttest.

In another study involving the same program used by the previous investigators, but in a programmed instructional context (Tobias, in press), there were no simple interactions between A-State and a scrambled, or logical instructional sequence. Predicted interactions between state anxiety and achievement on the technical posttest did not emerge, though triple interactions between sequence, SAI and state anxiety on the familiar posttest were found. With respect to A-State, this interaction suggested that, contrary to prediction, achievement on the scrambled sequence was relatively unaffected by A-State score, whereas in the regular sequence there was negatively related to A-State.

In two recently completed investigations (Tobias, 1972a; Tobias & Duchastel, 1972) A-State measures obtained during the instructional and test sequence have been used entirely as independent measures in order to assess the affective impact of the instructional procedures on the student. Inconsistencies in prior achievement data had indicated that the program, and posttests could profit from some revision. Also, in prior studies, students in the constructed response mode had typically reported themselves as being more tense than those in the reading condition. An intensive revision cycle was instituted (Tobias, 1972b) before the program was employed in the two most recent investigations. In these, it was found (Tobias, 1972a) that, contrary to the previous investigation, there were no main effects of response mode on state anxiety. An interaction between distraction, response mode, and the period of A-State assessment indicated that elevations of A-State in previous studies may well have been attributed to the fact that students viewed any evaluation of their responses

by the system, even during instruction, as a testing situation to which they responded with elevated anxiety. The group whose responses were not evaluated by the system had the lowest A-State scores.

While these studies differed in purpose, procedures, and subjects and could not be considered replications of one another, the lack of stability of interactions dealing with anxiety makes one hesitate regarding the generalizability of anxiety ATIs. The fact that the results did not replicate one another consistently can be ascribed to many reasons. From the present point of view, perhaps the most important is the nature of the in-task A-State measure³. Level of A-State is determined in the middle of instruction or evaluation; in turn, they effect the succeeding instructional or evaluative sequence. When A-State is used as an independent variable these two characteristics are inevitably confounded. It is, of course, easy to separate the effect of the instructional treatment on A-State by regression techniques. It is also equally easy to eliminate the effects of A-State on the treatment. What are we left with after such partialing out? In the one case, an estimate of A-State unaffected by the instructional manipulation, and in the other case a predicted instructional outcome free from the effect of anxiety. In neither case are such results especially enlightening with respect to ATIs. Reasoning similar to this led Cronbach⁴ to consider A-State as an intervening variable which can perhaps be best analyzed by path analysis procedures which are far from established at this stage.

What is one to make of these contradictory, complex, and confusing results relating to A-State anxiety? As has been suggested, one problem relates to the fact that state anxiety cannot be treated as either simply a

dependent or and independent variable. A second question must, however, be raised. Should we be looking at anxiety at all in interactions with II?

Anxiety, Difficulty, and Individualized Instruction

Perhaps one of the most replicated findings in the experimental literature dealing with anxiety is that anxiety facilitates performance on easy materials, but interferes with performance on complex materials. Many of the investigations referred to above have implicitly and explicitly referred to this finding. Typically, materials of varying difficulty were employed, and generally significant difference in the number of errors committed in the easy material and the difficult material reported. The question raised is: "Are significant differences in number of errors an adequate index that the task is difficult enough to arouse and maintain anxiety at sufficiently high levels for it to be debilitating to performance?" Some years ago, I attempted to review the experimental literature pertaining to difficulty and anxiety from this point of view. Typically, in this literature number of errors committed are reported, and significance tests between the number of errors are also reported. What is not reported, however, is the percentage of errors committed, i.e., what was the proportion of correct to incorrect responses? In the one study in an instructional context in which relatively large anxiety effects were observed (O'Neil, et al, 1969) an interaction between task difficulty and anxiety was found. The difficult materials used, consisting of mathematical problems and proofs, had approximate error rates of 73% and 60% for two sections. Error rates for the easy material were virtually zero. The difficult task was made

more complex since students could not advance to the next problem until they had solved the preceding one. Is it possible that for anxiety to have an effect on performance error rates of this magnitude have to be attained?

Individualized instructional practices minimize the percentage of error on the assumption that it is generally more conducive to learning for the pupil to make more correct, than incorrect responses. This is true for programmed instruction, CAI, and CMI. In each of these instructional strategies, levels of difficulty tend to be relatively low, and in any case certainly well below the 73% and 60% level of the O'Neil et al study.

What is being suggested, then, is that even when II strategies are altered to reduce their effectiveness the percentage of error of such instructional strategies is not sufficiently high to evoke and maintain anxiety in order for it to have its debilitating effect. Nor are the consequences of poor task performance sufficiently severe in such research settings to debilitate student test performance seriously. It may still be true that anxiety interacts with choice of instructional strategies where one strategy is individualized and the other a difficult lecture which the pupil has to master in one sitting. Two of the three studies comparing II and classroom based practices did not report such ATIs; however, the present rationale suggests that such interactions are possible. Within the II context, however, varying the II course is unlikely to yield interactions with anxiety since even in its most degraded form the materials are never difficult enough for anxiety to function consistently in its most debilitating form.

FOOTNOTES

1. Paper presented at symposium on "Anxiety in Educationally Relevant Situations," at the annual convention of the American Psychological Association, Honolulu, Hawaii, September, 1972.
2. Now at the City College, City University of New York.
3. This section of the paper has profited from a number of suggestions made by Dr. Paul F. Merrill.
4. Personal communication.

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